

TEMPORARY RAISED PAVEMENT MARKER (TRPM) APPLICATOR MACHINE
FOR AUTOMATICALLY APPLYING PAVEMENT MARKERS TO ROAD SURFACES

CROSS REFERENCE TO RELATED PATENT APPLICATION

5 This patent application is related in subject matter to the United States patent application which is entitled **TEMPORARY RAISED PAVEMENT MARKER (TRPM) APPLICATOR MACHINE FOR AUTOMATICALLY APPLYING PAVEMENT MARKERS TO ROAD SURFACES**, which was filed on September 20, 2002, and which
10 has been assigned Serial Number 10/247,436.

FIELD OF THE INVENTION

15 The present invention relates generally to temporary raised pavement markers (TRPMs) which are adapted to be fixedly secured to roadway surfaces in order to, for example, temporarily define traffic lanes or the like within construction zones, work sites, or maintenance or repair areas,
20 and more particularly to a new and improved machine for automatically applying such temporary raised pavement markers (TRPMs) to the roadway surfaces within such construction zones, work sites, or maintenance or repair areas.

BACKGROUND OF THE INVENTION

Various types of roadway markers have been utilized in connection with a variety of traffic control applications. Many roadway markers are adapted to be permanently attached or secured to the road surface so as to permanently delineate traffic lanes upon the roadway, while other roadway markers are adapted to be temporarily attached or secured to particular road surfaces in order to temporarily delineate traffic lanes within construction zones or other work areas. Accordingly, the latter type of roadway markers are known as temporary roadway markers and are usually attached or secured to the road surface by means of a suitable adhesive that can retain the roadway marker in its place upon the road surface during the temporary life of the roadway marker. More particularly, temporary roadway markers can serve, for example, as a means for identifying edge portions of the roadway, or alternatively, to delineate traffic lane lines and thereby demarcate separate lanes of traffic from each other in and around construction sites and other work zones. After the construction or other road work is completed, the temporary roadway markers are to be removed. In addition, to be effective, the temporary roadway markers must be capable of clearly alerting motorists to the fact that they are nearing or entering a construction zone or work area, and therefore, the temporary roadway markers must in fact be effective both during daytime hours, nighttime hours, sunny conditions, cloudy conditions, inclement weather conditions, and the like. More particularly, one type of temporary roadway marker that has been extremely successful or effective in providing short-term temporary markings

upon roadways both during daytime and nighttime hours, and which has also been able to adequately withstand the various impact forces that are normally impressed thereon by daily roadway vehicular traffic so as to in fact provide the desired service life required in connection with the installation of such temporary roadway markers, has been that type of temporary roadway marker which is known in the industry as a temporary raised pavement marker (TRPM). Examples of such temporary raised pavement markers (TRPMs) are disclosed, for example, within United States Patent 6,109,820 which issued to **Hughes, Sr.** on August 29, 2000, United States Patent 5,788,405 which issued to **Beard** on August 4, 1998, United States Patent 5,460,115 which issued to **Speer et al.** on October 24, 1995, United States Patent 4,991,994 which issued to **Edouart** on February 12, 1991, and United States Patent 4,445,803 which issued to **Dixon** on May 1, 1984.

As can readily be appreciated from **FIGURE 1**, which corresponds substantially to **FIGURE 1** of the **Speer et al.** patent, it is briefly noted that an exemplary temporary raised pavement marker (TRPM) 10 is seen to have a substantially L-shaped configuration wherein the horizontally disposed leg portion 12 thereof is adapted to be fixedly secured or attached to the road surface by means of a suitable adhesive which is allowed to set, while the vertically upstanding leg portion 14 is adapted to be visually seen by the oncoming motorist. A transition region 26 flexibly interconnects the vertically upstanding leg portion 14 to the fixed leg portion or base member 12. A pair of rib members or ledges 28,28 extend substantially perpendicular to the upstanding leg member 14 and serve to define a space or

channel 22 therebetween. A suitable reflective strip 23 is adapted to be fixedly disposed within the space or channel 22 so as to reflect sunlight or a vehicle's lights in order to provide the oncoming motorist, as indicated by the arrow 5 25, with a visual indication that the motorist is approaching or entering a construction zone or work area. Alternatively, in lieu of the reflective strip 23, the entire marker 10 may simply be brightly colored so as to similarly provide the oncoming motorist with the necessary visual warn-
10 ing.

With reference being further made to **FIGURE 2**, a temporary raised pavement marker (TRPM), which is similar to the temporary raised pavement marker (TRPM) 10 disclosed in **FIGURE 1** of the present drawings as well as within **FIGURE 1** 15 of the **Speer et al.** patent, is disclosed at 110 and is seen to likewise have a substantially L-shaped configuration. In particular, the temporary raised pavement marker (TRPM) 110 comprises a horizontally disposed leg or base member 112, and a vertically upstanding leg member 114 integrally connected to the horizontally disposed leg or base member 112 20 by means of a transitional region 116. An adhesive pad 118 is fixedly secured to an undersurface or lower face portion of the horizontally disposed leg or base member 112, and in turn, a release sheet 120 is secured to an undersurface or 25 lower face portion of the adhesive pad 118 so as to prevent the adhesive pad 118 from being inadvertently adhesively bonded to any surface, other than that particular location or portion of the roadway to which the temporary raised pavement marker (TRPM) 110 is to be fixedly secured, prior
30 to the actual fixation of the temporary raised pavement

marker (TRPM) 110 upon a selected location or portion of the roadway. As was the case with the temporary raised pavement marker (TRPM) 110 of **FIGURE 1** of the present drawings as well as those of Speer et al., the upper end portion of the vertically upstanding leg member 114 of the temporary raised pavement marker (TRPM) 110 also comprises a pair of horizontally disposed rib members 122, 122 which define a space or channel 124 therebetween for housing or accommodating a suitable reflector strip, not shown. Alternatively, the entire extrusion comprising the temporary raised pavement marker (TRPM) 110 may be fabricated from a suitable plastic material which is brightly colored, that is, it may be fabricated from a suitable resin material which is white or yellow.

The temporary raised pavement markers (TRPMs) 110 are normally placed upon the roadway surface during an extended period of time that construction or other road work is being performed upon the roadway surface, and therefore prior to the completion of the entire construction or other road work as well as the application of the permanent traffic lane lines to the roadway surface. Accordingly, in order to protect the reflector strip, not shown, which is adapted to be disposed, housed, or accommodated within the space or channel 124 defined between the pair of horizontally disposed rib members 122, 122, or alternatively, in order to protect the upper portion of the vertically upstanding leg member 114 when such portion of the temporary raised pavement marker (TRPM) 110 is to be used as the visual warning to oncoming motorists, from road paving materials, debris, and the like, a protective cover 126, fabricated from a suitable

clear plastic material and having a substantially inverted U-shaped configuration, is disposed over the upper free edge portion of the temporary raised pavement marker (TRPM) 110.

When the temporary raised pavement markers (TRPMs) 110 are to be subsequently used in conjunction with, for example, their traffic lane delineation functions, the protective covers 126 are removed, and still further, when the need for the temporary raised pavement markers (TRPMs) 110 is no longer required in view of the completion of the construction or other roadwork, and the application of the permanent traffic lane lines to the roadway surface, the temporary raised pavement markers (TRPMs) 110 must obviously be removed from the roadway surface. Until now, the process for mounting and securing the temporary raised pavement markers (TRPMs) 110 upon the roadway surfaces was accomplished manually whereby construction workmen or other personnel would have to manually deposit the temporary raised pavement markers (TRPMs) 110 onto the roadway surface as a result of, for example, removing the release sheet 120 and pressing the temporary raised pavement marker (TRPM) 110 onto the roadway surface so as to cause the adhesive bonding of the same to the roadway surface. Obviously, such procedures are quite tedious and time-consuming. In addition, in view of the fact that the construction workmen or other personnel are physically present upon the particular roadway surface during the performance of such temporary raised pavement marker (TRPM) application operations, the workmen or personnel are necessarily exposed to dangerous vehicular conditions present upon the roadway which is obviously undesirable from a safety point of view.

A need therefore exists in the art for a new and improved device, machine, or apparatus for automatically applying temporary raised pavement markers (TRPMs) to roadway surfaces so as to serve their useful purposes and functions in defining or delineating traffic lanes within construction zones or maintenance and repair areas, wherein, in particular, the temporary raised pavement markers (TRPMs) can be applied to the roadway surface in a relatively rapid manner, wherein the construction workmen or other operator personnel do not need to tediously perform such removal operations manually, and in addition, and just as importantly, wherein the operator personnel or construction workers will not be needlessly exposed to dangerous roadway conditions presented by oncoming automotive vehicular traffic. In addition, a need exists in the art for ensuring the fact that the apparatus for applying the temporary raised pavement markers (TRPMs) onto the roadway surface is properly maintained in engagement with the roadway surface despite irregularities encountered during movement along the roadway surface.

20 OBJECTS OF THE INVENTION

Accordingly, it is an object of the present invention to provide a new and improved device or apparatus for applying temporary raised pavement markers (TRPMs) to roadway surfaces.

25 Another object of the present invention is to provide a new and improved device or apparatus for applying

temporary raised pavement markers (TRPMs) to roadway surfaces whereby the operational drawbacks and disadvantages characteristic of the **PRIOR ART** techniques currently employed for applying the temporary raised pavement markers (TRPMs) to the roadway surfaces are effectively overcome.

An additional object of the present invention is to provide a new and improved device or apparatus for applying temporary raised pavement markers (TRPMs) to roadway surfaces wherein the temporary raised pavement markers (TRPMs) can be automatically applied to the roadway surfaces.

A further object of the present invention is to provide a new and improved device or apparatus for applying temporary raised pavement markers (TRPMs) to roadway surfaces wherein the temporary raised pavement markers (TRPMs) can be automatically applied to the roadway surfaces such that construction workers or other operator personnel do not have to manually apply such temporary raised pavement markers (TRPMs) to the roadway surfaces in a tedious and relatively slow manner, and wherein further, the workmen or other personnel are not unnecessarily exposed to dangerous roadway conditions presented by oncoming automotive vehicular traffic.

A last object of the present invention is to provide a new and improved device or apparatus for applying temporary raised pavement markers (TRPMs) to roadway surfaces wherein the temporary raised pavement markers (TRPMs) can be automatically applied to the roadway surfaces such that

the construction workers or other operator personnel do not have to manually apply such temporary raised pavement markers (TRPMs) to the roadway surfaces in a tedious and relatively slow manner, wherein the workmen or other personnel
5 are not unnecessarily exposed to dangerous roadway conditions presented by oncoming automotive vehicular traffic, and wherein the hitch mechanism interconnecting the towed vehicle to the roadwork service vehicle permits the towed vehicle to move independently of the roadwork service vehicle
10 cle so as to ensure the fact that the wheel applicators of the towed vehicle always remain properly engaged with the roadway surface.

SUMMARY OF THE INVENTION

The foregoing and other objectives are achieved in
15 accordance with the teachings and principles of the present invention through the provision of new and improved towed vehicle comprising apparatus or machinery for automatically applying temporary raised pavement markers (TRPMs) to roadway surfaces wherein the towed vehicle is operatively connected to a roadwork service vehicle or truck by means of a
20 suitable hitch mechanism so as to be towed along a roadway surface onto which a plurality of temporary raised pavement markers (TRPMs) are to be placed. The machine or apparatus comprises a pair of conveyors wherein the temporary raised
25 pavement markers (TRPMs) are deposited upon upstream end portions of the conveyors by means of an operator or workman stationed within a rear portion of the roadwork service ve-

hicle or truck, and the conveyors convey the temporary raised pavement markers (TRPMs) downstream to lower end portions disposed immediately above the roadway surface. A pair of applicator wheels are disposed adjacent to the lower end
5 portions of the conveyors, and in this manner, as the temporary raised pavement markers (TRPMs) are serially dispensed and discharged from the lower end portions of the conveyors and onto the roadway surface such that the normally vertical leg portion of each one of the temporary raised pavement
10 markers (TRPMs) is disposed in a horizontal mode or orientation upon the roadway surface, the applicator wheels effectively roll over the temporary raised pavement markers (TRPMs), engage the normally horizontal leg portion of each one of the temporary raised pavement markers (TRPMs), which
15 at this point in time is disposed vertically, and cause each one of the temporary raised pavement markers (TRPMs) to rotate about its transitional corner region such that the normally horizontal leg portion of each one of the temporary raised pavement markers (TRPMs) is now secured to the roadway surface by means of its adhesive pad.
20

In addition to the conveyor and applicator wheel apparatus for achieving the automatic application of the temporary raised pavement markers (TRPMs) onto the roadway surface, the hitch mechanism operatively interposed between
25 the roadwork service vehicle and the towed vehicle provides for pivotal movement of the hitch mechanism so as to permit the towed vehicle, upon which the conveyors are disposed, to effectively move independently of the roadwork service vehicle such that the towed vehicle, and the conveyor and wheel
30 applicator mechanisms thereof, are always maintained proper-

ly engaged with, and with respect to, the roadway surface upon which the temporary raised pavement markers (TRPMs) are to be applied. Application of the temporary raised pavement markers (TRPMs) onto the roadway surface in adjacent pairs
5 simulates, for example, double-yellow traffic lane lines for separating opposite lanes of vehicular traffic.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features, and attendant advantages of the present invention will be more fully appreciated from the following detailed description when considered in connection with the accompanying drawings in which
10 like reference characters designate like or corresponding parts throughout the several views, and wherein:

FIGURE 1 is a perspective view of a conventional
15 **PRIOR ART** temporary raised pavement marker (TRPM);

FIGURE 2 is a perspective view of a temporary raised pavement marker (TRPM) of the type which is adapted to be applied to a roadway surface, by means of the device, machine, or apparatus constructed in accordance with the
20 principles and teachings of the present invention, in order to desirably define or delineate simulated roadway traffic lines;

FIGURE 3 is a partially exploded perspective view of a new and improved apparatus, as constructed in accord-

ance with the principles and teachings of the present invention, for automatically applying temporary raised pavement markers (TRPMs) onto a roadway surface, as well as the new and improved hitch mechanism for interconnecting the
5 towed vehicle, upon which the new and improved apparatus for automatically applying the temporary raised pavement markers (TRPMs) onto the roadway surface is mounted, to the roadwork service vehicle;

FIGURE 4 is an assembled perspective view, similar
10 to that of **FIGURE 3**, showing the new and improved apparatus, for automatically applying temporary raised pavement markers (TRPMs) onto the roadway surface, as well as the new and improved hitch mechanism for interconnecting the towed vehicle to the roadwork service vehicle such that the new and im-
15 proved apparatus for automatically applying temporary raised pavement markers (TRPMs) onto the roadway surface is disposed in its marker application mode;

FIGURE 5 is an enlarged perspective view showing the details of the lower end portion of the pair of conveyor
20 mechanisms of the new and improved apparatus of the present invention for delivering and discharging the temporary raised pavement markers (TRPMs) onto the roadway surface such that the temporary raised pavement markers (TRPMs) can be secured to the roadway surface by the applicator wheel as-
25 semblies;

FIGURE 6 is a top plan view of the new and improved apparatus of the present invention comprising the conveyor mechanisms for delivering and discharging the temporary

raised pavement markers (TRPMs) onto the roadway surface, as well as the wheel applicator assemblies for applying and securing the temporary raised pavement markers (TRPMs) onto the roadway surface;

5 **FIGURE 7** is an enlarged perspective view similar to that of **FIGURE 5** showing additional details of the lower end portions of the temporary raised pavement marker (TRPM) conveyor mechanisms;

10 **FIGURE 8** is an exploded perspective view of the new and improved hitch mechanism constructed in accordance with the principles and teachings of the present invention for interconnecting the towed vehicle to the roadwork service vehicle;

15 **FIGURE 9** is a perspective view illustrating the new and improved hitch mechanism, as disclosed within **FIGURE 8**, as attached to both the towed vehicle and the roadwork service vehicle wherein the hitch mechanism is disposed within a non-pivoted horizontally oriented mode;

20 **FIGURE 10** is a view similar to that of **FIGURE 9** showing, however, the hitch mechanism as disposed within a slightly downwardly inclined pivotal mode;

FIGURE 11 is a view similar to those of **FIGURES 9** and **10** showing, however, the hitch mechanism as disposed within a substantially downwardly inclined pivotal mode; and

25 **FIGURE 12** is perspective view similar to that of

FIGURE 4 wherein, however, the hitch mechanism, as more specifically disclosed within FIGURES 8-11, has been removed such that the towed vehicle is attached directly to the roadwork service vehicle during the non-application, transportation mode of the new and improved apparatus of the present invention for automatically applying the temporary raised pavement markers (TRPMs) onto the roadway surface.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, and more particularly to FIGURE 3-7 and 12 thereof, a new and improved apparatus or machine for automatically applying temporary raised pavement markers (TRPM) to roadway surfaces is disclosed and is generally indicated by the reference character 210. The machine or apparatus 210 is seen to comprise a wheeled vehicle 212 comprising a vehicle chassis or framework 214 which is rollably supported by means of a pair of transport wheel assemblies 216, and a trailer hitch assembly 218 which permits the machine or apparatus 210 to be pulled along a roadway surface 220 by means of a roadwork service vehicle or truck 222, the vehicle 212 adapted to also comprise an enclosure, not shown. More particularly, and as will be described in more detail hereinafter, the trailer hitch assembly 218 is seen to comprise a longitudinally extending tow bar 224 which is integrally connected to the towed vehicle chassis or framework 214, and a transversely extending pivotal hitch connector 226 which is adapted to interconnect the tow bar 224 of the trailer hitch assembly

218 to a fixed tubular mounting bar 228 which is fixedly mounted upon a rear end chassis portion of the roadwork service vehicle or truck 222.

In this manner, when the new and improved apparatus or machine 210 of the present invention is to be used for automatically applying temporary raised pavement markers (TRPMs) 110 to the roadway surface 220, the transversely extending pivotal hitch connector 226 is operatively interconnected between the tow bar 224 of the trailer hitch assembly 218 and the fixed tubular mounting bar 228 of the roadwork service vehicle or truck 222 so as to properly position the wheeled vehicle 212 at its proper longitudinally offset position with respect to the roadwork service vehicle or truck 222, as disclosed within **FIGURE 4**, whereby, for example, a plurality of temporary raised pavement markers (TRPMs) are adapted to be applied to the roadway surface 220 in dual sets of markers 110 so as to effectively simulate, for example, a double yellow line which conventionally separates oppositely directed or oncoming lanes of vehicular traffic. Alternatively, when the new and improved apparatus or machine 210 of the present invention is not being used for automatically applying temporary raised pavement markers (TRPMs) 110 to the roadway surface 220, and is adapted to be simply towed behind the roadwork service vehicle or truck 222 while the roadwork service vehicle or truck 222 is being operated at relatively high speed upon a highway, such as, for example, when the apparatus 210 of the present invention is being transported either to or from a work site, the transversely extending pivotal hitch connector 226 is removed and the tow bar 224 of the trailer hitch assembly 218 is

connected directly to the fixed tubular mounting bar 228 of the roadwork service vehicle or truck 222 as disclosed within **FIGURE 12**.

As can best be appreciated from **FIGURES 3,4,** and
5 12, the new and improved apparatus or machine 210 of the present invention is seen to further comprise a pair of laterally or transversely spaced, longitudinally oriented inclined conveyor assemblies 230,230. Upper end portions 232, 232 of the inclined conveyor assemblies 230,230 are adapted
10 to be disposed at an elevation which is above the tailgate portion 234 of the roadwork service vehicle or truck 222, as best seen in **FIGURE 4**, such that when an operator or workman is, for example, standing upon the deck or bed 236 of the roadwork service vehicle or truck 222, the upper end portions 232,232 of the conveyor assemblies 230,230 are readily
15 accessible to the operator or workman so as to enable the operator or workman to successively place the temporary raised pavement markers (TRPMs) 110 onto the conveyor assemblies 230,230. Each one of the conveyor assemblies 230,230
20 is seen to comprise a downwardly movable conveyor belt 238, and a plurality of upstanding carrier members 240 are fixedly mounted upon each conveyor belt 238. Individual ones of the temporary raised pavement markers (TRPMs) 110 are adapted to be respectively mounted upon the conveyor belt carriers 240 in a substantially inverted mode such that, after
25 the release liner or sheet 120 has been removed from each one of the temporary raised pavement markers (TRPMs) 110, the transitional corner region 116 of each temporary raised pavement marker (TRPM) 110 extends upwardly away from the
30 surface of the conveyor belt 238, the normally vertically

oriented leg member 114 of the temporary raised pavement marker (TRPM) 110 is oriented in the upstream direction upon the conveyor belt 238, and the normally horizontally oriented leg member 112 of the temporary raised pavement marker (TRPM) 110 is oriented in the downstream direction upon the conveyor belt 238.

In this manner, when the individual temporary raised pavement markers (TRPMs) 110 are serially discharged from lower end portions 242,242 of the conveyor assemblies 230,230, which are adapted to be disposed directly above the roadway surface 220 as best seen in **FIGURES 3** and **5-7**, each one of the temporary raised pavement markers (TRPMs) 110 will be disposed, in effect, upon the roadway surface 220 in a knocked-down state whereby the normally vertically oriented leg member 114 of the temporary raised pavement marker (TRPM) 110 will be disposed horizontally upon the roadway surface 220 while the normally horizontally oriented leg member 116 of the temporary raised pavement marker (TRPM) 110 will be disposed vertically upwardly with respect to the roadway surface 220. Accordingly, a pair of applicator wheels 244,244, which are disposed immediately adjacent to each one of the lower end portions 242,242 of the conveyor assemblies 230,230, are able to immediately engage the horizontally disposed leg member 114 of the temporary raised pavement marker (TRPM) 110 so as to substantially retain the temporary raised pavement marker (TRPM) 110 at the particularly desired position upon the roadway surface 220 at which the temporary raised pavement marker (TRPM) 110 is to be applied to the roadway surface 220, and subsequently roll over the particular temporary raised pavement marker (TRPM) 110

so as to effectively upend the temporary raised pavement marker (TRPM) 110 to its normal orientation whereby the temporary raised pavement marker (TRPM) 110 will be secured to the roadway surface 220 by means of its adhesive pad 118.

5 With reference continuing to be made to **FIGURES 3-7 and 12**, it is seen that each one of the inclined conveyor assemblies 230,230 comprises a substantially U-shaped conveyor track member 246 comprising a pair of laterally or transversely spaced, upstanding side walls 248 and an upper
10 support surface of a support member 250, interposed between the side walls 248, upon which the conveyor belt 238 is movably supported. The framework or chassis 214 comprises a horizontally disposed platform section 252 and an inclined framework section 254 integrally connected to the platform
15 section 252, and it is further seen that the inclined framework section 254 comprises a pair of cross-bars 256,256 to which lower end portions of the pair of conveyor track members 246 are fixedly secured by means of, for example, bolt fasteners, not shown. As has been noted, the conveyor belt
20 238 of each conveyor assembly 230 is adapted to be conducted along the upper support surface of the support member 250 of each conveyor track member 246, and is of course adapted to be routed along a return path which is disposed beneath the support member 250. Accordingly, as may best be appreciated
25 from **FIGURE 3**, the uppermost end portion of each conveyor assembly 230,230 is provided with an idler pulley 258 which is mounted upon the conveyor assemblies 230,230 by means of suitable mounting brackets 260, only one of the idler pulleys 258 actually being shown, and a drive pulley, not visible,
30 ble, is similarly provided at the lowermost end portion of

each conveyor assembly 230,230.

As best seen in **FIGURES 3,5, 7, and 12**, the lowermost end portion of each one of the conveyor assemblies 230, 230 is interposed between a pair of mounting brackets 262, 262 which are fixedly secured to a forwardly disposed member 264 of the horizontally disposed platform section 252 of the framework or chassis 214, and a conveyor drive motor 266 is mounted upon the laterally outer one of each pair of mounting brackets 262,262 by means of a suitable mounting bracket 268 and a plurality of mounting shafts 270 such that a motor drive shaft 272 of each conveyor drive motor 266 is operatively connected to the conveyor drive pulley, not shown. Substantially completing the structure of the horizontally disposed platform section 252 of the framework or chassis 214, it is seen that each set or pair of the plurality of temporary raised pavement marker (TRPM) applicator wheels 244 are mounted upon suitable mounting brackets 274 which are, in turn, fixedly mounted upon a rearwardly disposed frame member 276 of the horizontally disposed platform section 252 of the framework or chassis 214, and the axles of the temporary raised pavement marker (TRPM) applicator wheels 244 are operatively mounted within suitable enclosed spring assemblies 275 which are mounted upon the mounting brackets 274. An electronics housing 278, within which suitable electronics are disposed for the operation of, for example, the conveyor assemblies 230,230, is likewise fixedly mounted upon the horizontally disposed platform section 252 of the framework or chassis 214 by means of suitable mounting bracket and angle iron members 279, and the system electronics are adapted to be electronically connected to a

suitable program logic controller (PLC) 280 which is provided for controlling, for example, the drive speed of the conveyor drive motors 266,266 such that the conveyor assemblies 230,230 can convey and discharge a predetermined number of
5 temporary raised pavement markers (TRPMs) 110 within a predetermined period of time whereby the temporary raised pavement markers (TRPMs) 110 are applied to the roadway surface 220 at predeterminedly spaced positions therealong.

Continuing further, it is seen that the tow bar
10 224 of the trailer hitch assembly 218 is integrally connected to the inclined framework section 254 of the towed vehicle framework or chassis 214 by means of a pair of divergent angle bars or arms 282,282 which are arranged with respect to each other in a substantially V-shaped array, and that a
15 third transport wheel assembly 284 is fixedly secured to the trailer hitch assembly 218 by means of a mounting bracket 286 which is secured to the pair of divergent angle bars or arms 282,282 at the junction of the V-shaped array. In accordance with a unique and novel feature characteristic of
20 the present invention, the towed vehicle framework or chassis 214 is adapted to be movable between a first relatively lowered position with respect to the roadway surface 220, at which the plurality of temporary raised pavement marker (TRPM) applicator wheels 244 and the third transport wheel
25 assembly 284 are adapted to be disposed in contact with the roadway surface 220, so as to facilitate the application of the plurality of temporary raised pavement markers (TRPMs) 110 onto the roadway surface 220, and a second relatively elevated position with respect to the roadway surface 220,
30 at which the plurality of temporary raised pavement marker

(TRPM) applicator wheels 244 and the third transport wheel assembly 284 are adapted to be disengaged from the roadway surface 220, such as, for example, when the plurality of temporary raised pavement markers (TRPMs) 110 are no longer being applied to the roadway surface 220, so as to facilitate, for example, high-speed travel of the towed vehicle 212 by means of the roadwork service vehicle or truck 222.

In order to achieve the elevational movements of the towed vehicle framework or chassis 214 between the aforenoted first and second positions with respect to the roadway surface 220, a pair of stub shafts 288,288 are fixedly secured to oppositely disposed, laterally spaced upper side portions of the rearwardly disposed frame member 276 of the horizontally disposed platform section 252 of the towed vehicle chassis or framework 214, and a pair of substantially L-shaped arms 290,290 are pivotally mounted, by means of collar portions 292,292 formed at the junctions defined between the leg portions forming the L-shaped arms 290,290, upon the stub shafts 288,288. In addition, first, substantially horizontally oriented end portions 294,294 of the L-shaped arms 290,290 are adapted to be pivotally mounted upon the axle assemblies 296,296 of the pair of transport wheels 216,216, while second opposite substantially vertically oriented or upstanding end portions 298,298 of the L-shaped arms 290,290 are adapted to have eyelet members 300,300 fixedly mounted therein. A pair of bail assemblies 302,302 are rotatably mounted upon the upper one of the cross-bars 256 of the inclined framework section 254 of the towed vehicle chassis or framework 214, and the bail members of the bail assemblies 302,302 are adapted to be rotated by means of

suitable crank mechanisms 304 such that cables, not shown but having first end portions thereof respectively secured upon the bail members of the bail assemblies 302,302, and having second end portions thereof fixedly connected to the eyelets 300,300 fixedly mounted within the upper end portions 298,298 of the L-shaped arm members 290,290, can be wound upon the bail members of the bail assemblies 302,302.

Accordingly, as the cables are wound upon the bail members of the bail assemblies 302,302, the L-shaped arms 290,290 will be pivoted from their substantially inclined positions as shown in **FIGURE 4** to their substantially vertically oriented positions as shown in **FIGURE 12**. It is to be appreciated, however, that in view of the fact that the L-shaped arms 290,290 are pivotally mounted at their first end portions 294,294 upon the axle assemblies 296,296 of the transport wheels 216,216, and in view of the additional fact that the axle assemblies 296,296 of the transport wheels 216,216 will not move elevationally because the transport wheels 216,216 are always rollably disposed upon the roadway surface 220, then the L-shaped arms 290,290 will effectively pivot or move in an arcuate manner around the axes defined by means of the transport wheel axles 296,296. Consequently, in view of the additional fact that the L-shaped arms 290,290 are pivotally mounted by means of their collar portions 292,292 upon the stub shafts 288,288 which are fixed upon the rearwardly disposed frame member 276 of the horizontally disposed platform section 252 of the towed vehicle chassis or framework 214, then it is to be appreciated that as the L-shaped arms 290,290 are pivotally moved in their arcuate mode from their substantially inclined positions as shown in

FIGURE 4 to their substantially vertically oriented positions as shown in **FIGURE 12**, the entire towed vehicle framework or chassis 214 will accordingly be pivoted as additionally permitted by means of the universal ball member assembly, not shown in **FIGURE 12** but which will be discussed hereinafter, which conventionally connects the tow bar 224 of the trailer hitch assembly 218 to the mounting bar 228 of the roadwork service vehicle or truck 222. It is to be noted further that the bail assemblies 302,302 are provided with suitable pawl mechanisms, not shown, such that the cables wound upon the bail assemblies 302,302 may be optionally retained in any one of a multitude of wound states, or released, as desired.

It is lastly noted in conjunction with the overall structure of the towed vehicle framework or chassis 214, and the mounting of the same upon the pair of transport wheels 216,216, that, as best seen in **FIGURES 3,4,6, and 12**, a pair of leaf spring members 306,306 have first end portions thereof respectively connected to the first end portions 294,294 of the L-shaped arms 290,290, while second end portions of the leaf spring members 306,306 are adapted to be connected to mounting brackets 308,308 fixedly disposed upon opposite end portions of the forwardly disposed member 264 of the horizontally disposed platform section 252 of the framework or chassis 214 by means of suitable fastener assemblies 310,310. It is noted further, as can best be respectively appreciated from **FIGURES 4 and 12**, that when the temporary raised pavement marker (TRPM) applicator apparatus 210 of the present invention is disposed in its temporary raised pavement marker (TRPM) applicator mode, that is, when

the framework or chassis 214 is disposed at its elevational-
ly lowered position such that the two sets of temporary
raised pavement marker (TRPM) applicator wheels 244, as well
as the third transport wheel 284, are disposed upon the
5 roadway surface, the leaf spring members 306,306 are discon-
nected from the mounting brackets 308 of the framework or
chassis 214, whereas when the temporary raised pavement
marker (TRPM) applicator apparatus 210 of the present inven-
tion is disposed in its high-speed transportation mode, that
10 is, when the framework or chassis 214 is disposed at its el-
evationally raised position such that the two sets of tempo-
rary raised pavement marker (TRPM) applicator wheels 244, as
well as the third transport wheel 284, are disengaged from
the roadway surface, the leaf spring members 306,306 are
15 connected to the mounting brackets 308 of the framework or
chassis 214.

With reference lastly being made to **FIGURES 3,4,**
and **8-11**, the new and improved transversely extending pivot-
al hitch connector 226 of the present invention will now be
20 described. As has been noted hereinbefore, the new and im-
proved hitch connector 226 is adapted to be utilized with
the temporary raised pavement marker (TRPM) applicator appa-
ratus 210 of the present invention only when the temporary
raised pavement marker (TRPM) applicator apparatus 210 of
25 the present invention is disposed in its temporary raised
pavement marker (TRPM) application mode, whereas, when the
temporary raised pavement marker (TRPM) applicator apparatus
210 of the present invention is disposed in its high-speed
transportation mode, the new and improved hitch connector
30 226 of the present invention is adapted to be disconnected

and removed from the temporary raised pavement marker (TRPM) applicator apparatus 210 of the present invention whereby, for example, the towed vehicle 212 is adapted to be directly connected to the roadwork service vehicle or truck 222 as disclosed within **FIGURE 12**. More particularly, as can best be appreciated from **FIGURE 8**, the new and improved hitch connector 226 of the present invention is seen to comprise two primary components, the first one of which is a dual-plate pivotal connector 312, and the second one of which is a dual-rod lateral adjustment connector 314.

The dual-plate pivotal connector 312 is seen to comprise a pair of vertically spaced parallel plates 316,316 wherein each one has a pair of pivotal collars 318,320 at opposite ends thereof. The first set of pivotal collars 318 are adapted to be pivotally connected, by means of suitable fastener assemblies 321, to mounting brackets 322 which are fixedly secured to the mounting bar 228 of the roadwork service vehicle or truck 222, while the second set of pivotal collars 320,320 are adapted to be pivotally connected, by means of suitable fastener assemblies 324, to mounting brackets 326 which are fixedly secured to one end of the dual-rod lateral adjustment connector 314. The dual-rod lateral adjustment connector 314 is seen to comprise a pair of transversely extending rods 328,328 which are separated from each other so as to permit a threaded rod portion 330 of a trailer hitch universal ball member 332 to extend through the space 334 defined between the pair of rods 328,328 and thereby be threadedly engaged with a nut member 336. A pair of mounting plates 338,338 are adapted to be disposed in slidable engagement with upper and lower surface portions of

the rods 328,328 so as to effectively define a slidable mounting system for the universal ball-nut assembly 332-336. In this manner, when the universal ball member 332 is engaged with a socket member 340 operatively disposed upon the
5 tow bar 224 of the trailer hitch assembly 218, and the relative position of the universal ball member 332 and the tow bar 224 of the trailer hitch assembly 218 are transversely or laterally adjusted with respect to the adjustment connector 314, the lateral or transverse disposition of the entire towed vehicle 212 with respect to the roadwork service
10 vehicle or truck 222 can be positionally adjusted as desired or required. The interdisposition of the pivotal connector 312 between the adjustment connector 314, which is connected to the tow bar 224 of the towed vehicle 212, and the mounting bar 228, which is connected to the roadwork service vehicle or truck 222, provides for a pivotal connection to be
15 established between the tow bar 224 of the towed vehicle 212 and the mounting bar 228 of the roadwork service vehicle or truck 222 which effectively permits the towed vehicle 212 to experience different elevational movements independent of or
20 with respect to the roadwork service vehicle or truck 222 as may be appreciated, for example, from **FIGURES 9-11.**

Thus, it may be seen that in accordance with the principles and teachings of the new and improved automatic
25 apparatus for applying temporary raised pavement markers (TRPMs) to roadway surfaces, there has been disclosed a conveyor for serially feeding a plurality of temporary raised pavement markers (TRPMs) from an upper elevational position, which is accessible by means of operator or work-
30 men personnel disposed within the roadwork vehicle or truck,

to a lower elevational position which is located immediately above the roadway surface onto which the temporary raised pavement markers (TRPMs) are to be applied. In addition, there is also disclosed a new and improved trailer hitch mechanism which provides for the independent elevational movement of the towed vehicle with respect to the towing roadwork service vehicle or truck.

Obviously, many variations and modifications of the present invention are possible in light of the above teachings. For example, while the trailer hitch assembly 218 has been disclosed as being connected directly to the mounting bar 228 of the roadwork service vehicle or truck 222 when the apparatus of the present invention is not being utilized for applying temporary raised pavement markers (TRPMs) to the roadway surface and is disposed in its high-speed transport mode, the trailer hitch assembly 218 can of course be connected to the mounting bar 228 of the roadwork service vehicle or truck 222 by means of a conventional universal ball connection system. It is therefore to be understood that within the scope of the appended claims, the present invention may be practiced otherwise than as specifically described herein.

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